metres. The labour to attain even such accuracy is very great. The surprise is that at Upsala they did not adopt a photographic theodolite such as is now, we believe, in daily use at Kew. In the Kew "nephographs," as they are called, the telescope is replaced by a camera, and the observations do not involve half the labour of eye-observations. For instance, when the two nephographs are in a fixed position the manipulations are simplicity itself. One observer telephones to the other the cloud whose height it is desired to ascertain. By means of a very simple pointer both direct their cameras to the cloud, having inserted a dry plate in position. The lenses are closed by shutters, both of which can be opened and then closed with any desired rapidity by an electrical arrangement from one station. The exposures are thus made simultaneously, and the photograph must include every point in the cloud. The position of the cloud is fixed by crossed lines etched on a glass plate which is in contact with the dry plate, and which always occupies the same position, and from these cross lines, which are impressed on the two negatives, any desired point is measured. The readings of the graduated circles of the nephoscope having been taken the height and distance of the cloud is readily calculated. It might be supposed that considerable errors might be made even with this arrangement as the solid angular distance included is somewhere about 55°, and the objects within this are impressed on a plate less than six inches square. As a matter of fact, such is not the case. Measurements of objects a couple of miles off, and at known distances from the observer, have been observed with an error of less than 1 per cent., a base of 250 yards having been used—an accuracy which is far greater than could be obtained by eye-observations when the object to be observed is uncertain in outline, and when there is no definitely fixed point to observe. It must not, however, be supposed that there are no difficulties in photographing clouds of every description. It requires, for instance, a keen judgment to hit off the exposure necessary to differentiate between the white clouds in the higher regions the pale blue sky against which they are projected. All such difficulties are to be overcome with practice. It is to be hoped that before long the Upsala Observatory will adopt such a plan as we have indicated, when the results they obtain will be even more valuable and be less laboriously attained than they are at present.

The following table gives the height of the different characters of clouds at Upsala :—

Stratus		625 metres.
Nimbus (lower)		1,115 „
„ higher		2,185 „
Cumulus and cumulo-stratus	top	1,690
	base	1,307
	mean	1,498
Lower alto-cumulus		1,988
Higher „ „		4,242
Cirro-cumulus		5,513
Cirrus		6,823

The authors point out that, according to their observations, apparently there are seven levels, each one occupied by a different species of cloud, viz. : 600, 1,100, 1,500, 2,000, 42-4,600, 58-6,600, and 80-8,600 metres ; and these levels agree with those deduced by M. Vettin of Berlin, who deduced them from a different mode of observation. There are several remarkable tables, some of which give the diurnal variation in the height of clouds, others the diurnal variation of the frequency of high clouds at Upsala during the summer, others again which discuss the question of the effect of the height of the barometer on the cloud masses. One of the most interesting sections of the memoir is that on the calculation of the velocity of wind at different heights from the movements of clouds.

On the whole, the Observatory at Upsala is to be congratulated on the step it has taken in making systematic observations of cloud heights and velocities. It is a matter of capital importance to meteorology that such should be undertaken in various localities, not only at or near the sea level, but also at as high altitudes as possible. Were the cloud levels, for instance, the same at all places, mountainous districts would be very much more cloud bound than we know is the case. Observations of clouds in the Alps show that the levels at which the different classes are to be found exceed the heights which are shown in the table above ; and it remains to ascertain not only the effect of barometic pressure on the levels, but also the disturbing effect caused by the elevations in the land. Such observations might well be added to the observatory at Ben Nevis, and no doubt some enthusiastic meteorologist would be willing to spend a summer in the Alps to make observations at a still higher station. Until work such as this is undertaken the subject can only be partially discussed on scientific grounds.

W. DE W. A.

THE RECENT TOTAL ECLIPSE OF THE SUN

WE have received the following communications :—

THE news that bad weather seriously interfered with the work of the Government Survey parties, sent to observe the eclipse of the 9th inst. from points on the centre line of totality, induces me to send you the accompanying incomplete sketch and hasty account by to-day's mail :—

I observed the eclipse from Tahoraite, the present southern terminus of the Napier-Wellington Railway, a point well within the belt of totality, but some forty miles north of the centre line.

I went, determined to concentrate my whole attention on the corona, and the corona alone—I did not even take my watch. My eclipse observations are therefore necessarily very incomplete.

After a stormy night (alternate showers of rain and hail, with a bitterly cold wind), day-dawn brought a clear sky ; but a heavy bank of clouds far away to the south boded no good to observers in that direction. The cold was bitter, and fresh snow lay very low down on the neighbouring hills.

The first contact occurred not long after sunrise, the atmosphere in the east being rather hazy, and the light *pale* (other observers say *ruddy*). At first the temperature of the air seemed to rise steadily, but when the sun's disk was a quarter obscured, it began to fall again, and as totality approached the cold became severe.

When the occultation of the sun had reached three-quarters, the so-called "livid" character of the light became very marked, and about ten minutes before totality a curious and tremulous play of light on the ground—like dark ripples or moving "marblings," if I may use the word, became apparent.

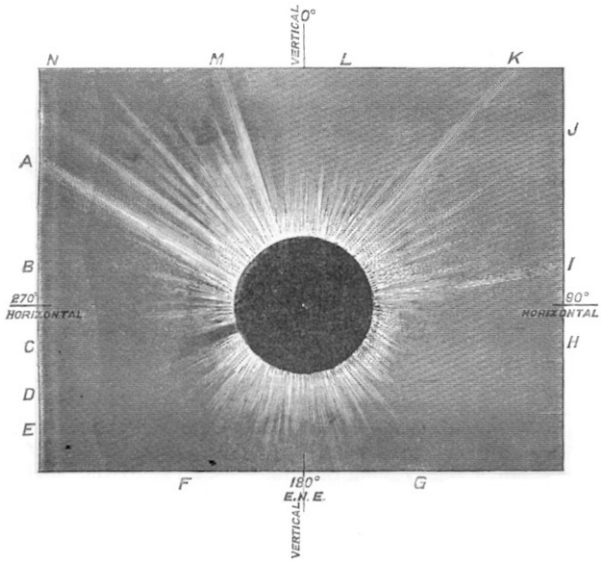
In order to keep my eyes as sensitive as possible to the faint light of the corona when it should become visible, I only watched the sun (through a telescope) for a few minutes after first contact, I then averted my gaze, and fixed it persistently on the dark-green bush surrounding the Tahoraite clearing. All I noticed during my hasty survey of the disk was two small and one large spot, the latter close to the limb at about 90° (see sketch), and surrounded by faculæ.

The moment "totality" occurred I turned my gaze towards the sun, and having previously, to save time, drawn disks on several pages of my pocket-book, I hurriedly took sketch after sketch of the shape of the corona, the rays of which were much better marked than I had been led to expect. My object in taking several sketches was to record any change in the position of the rays. I took five during the short time of totality, and their agreement is so clear as regards the number and relative

position and length of the main rays, that it fully confirms the general impression left on my mind as to the fixity of this phenomenon.

I was just engaged in making a last estimate of the extent of the corona between 35° and 90°, when a cry arose from the bystanders, "Look at the red flame shooting out to the left!" I withstood the temptation, and observed the almost sudden disappearance of the corona on the reappearance of the sun. All I can therefore say of the red protuberance which attracted so much notice is that the emergence of the sun is blended in my mind with a vague and fleeting impression of a narrow streak of red light with a broad streak of white light outside it, between 200° and 290°, and almost symmetrically divided by the position of the dark rift in the corona.

An acquaintance who noticed the rift in the corona told me that the red flame shot out close to it. He described the shape of the flame as *ragged;* other intelligent observers compared it to a *sugarloaf;* the most intelligent



Corona as observed during solar eclipse of September 9, 1885, as seen from Tahoraite, North Island, New Zealand, about 40 miles north of centre line of totality;—A, 300°; longest ray, 2·3 diams. B, first contact about 285° (vague). C, Sun apparently reappears about 260° (vague). D, 250°; dark rift in corona. E, approximate position of large red protuberance which shot out just before close of totality. F, corona, $\frac{1}{8}$ diam., rather ragged. G, corona, $\frac{1}{8}$ diam., regular. H, large sun-spot with faculæ close to the limb at time of first contact. I, 80°; 3rd longest ray, $1\frac{1}{2}$ diam. J, between these two long rays corona extends nearly $\frac{3}{4}$ diam., with some longer rays. K, longest ray, $1\frac{1}{4}$ diam. L, corona, hardly $\frac{1}{8}$ diam. M, 2nd longest ray, $1\frac{1}{2}$-2 diams. N, between longest rays corona extends $\frac{3}{4}$ to 1 diam.; 2 long rays $1\frac{1}{4}$ diam. (N.B.—Corona alone was observed: relative position and lengths of rays reliable; absolute lengths to be taken with caution.)

of those I heard, to a *drop of water* hanging from an object. Other observers, again, stationed two miles off, saw, *not a red* but a brilliant *white* flame shoot out.

I leave these discordant statements and comparisons to be reconciled by other men.

During totality there was a considerable amount of diffused light around the sun. I am unable to state its extent or colour from personal estimate. Some of the bystanders called the colour pearl-grey; others, reddish; others, again, pale blue and white.

The colour of the corona itself seemed to me very pale bluish green.

The sketch I send you should explain itself. I will only mention that the angles are, of course, only estimated, the zero direction being the upper end of the vertical through the centre of disk.

The rift in the corona was very marked, and extended right down to the disk; it was very near to by far the longest of the rays. In conclusion there is nothing that the coronal rays remind me of so much as an auroral display. N. A. GRAYDON

Hastings, Hawkesbay, N.Z., September 11

Mr. Henry Bedford, of All Hallow's College, Dublin, sends us a copy of the *Marlborough Express*, New Zealand, of Wednesday, September 9, 1885, giving an account of the eclipse as observed at Blenheim and other places in New Zealand.

The eclipse at Blenheim began at 6.30 a.m., and totality occurred at 7.25.

"The totality—if totality it was—could have lasted but a bare moment: for, to the untrained observer, it seemed that a patch of bright sunlight on the upper edge of it was never absent. It must, however, be remembered that Blenheim is on the very outer edge of the belt, and that the apparent duration of totality was so extremely short that, by an optical illusion, it might seem that sunlight was never totally obscured. The corona and sun's flames were plainly visible, and formed a spectacle which no mechanical contrivance can imitate, and no art can reproduce. Several stars in different quarters of the heavens—and particularly one about four sun's diameters below the eclipse—were seen, and the general appearance of the sky and of the shadows on the hill sides and in the water was that of early dawn. The eclipse was certainly a wonderful phenomenon, and almost as interesting to the non-scientific observer as to the man of science who viewed it in his observatory.

"Observations of the eclipse were taken in the cricket ground at Blenheim by Mr. Dobson, C.E., and ten instantaneous photographs were secured by Mr. W. H. Macey, the two gentlemen acting in conjunction. Mr. Dobson's observations were made by the telescope and theodolite, the powerful telescope belonging to Mr. Cullen of Mahikipawa having been erected in the cricket ground for the purpose."

At Wellington, by the time the total phase was reached the sun was sufficiently clear of clouds to give an uninterrupted view. As totality was reached the scene was most impressive, and as the darkness increased the western heavens became illuminated with a deep orange colour, shading off into the most delicate of yellows. A number of stars were plainly seen during the darkness. After about a minute and a half the sun again shone out, and gradually increased. Pigeons and birds began to fly about in a helpless fashion, and sought their roosts.

Dr. Hector reports:—"Heavy southerly squalls, with hail, spoiled the observations. We were at Dryertown, on the centre of the line, but got only partial glimpses. A pink patch surrounded the sun, and extended 15° from it, probably due to the same dust film in a high atmosphere that caused the sun-glows last year."

At Mastertton a heavy south-west gale with rain set in on the 8th, and the morning broke without any signs of clearing. Messrs. M'Kerrow and party, who had camped at the foot of Otahuao, proceeded to the top and fixed their instruments amid driving snow and hail. Just before totality the sky cleared, and all the phenomena were fairly visible. One photograph was taken before totality, three during, and one after. The corona was visible for fully a minute, encircling a ring of light radiating to a distance of about half a diameter of the sun. It was of a pale white colour, like the electric light; of uniform width, except at the sun's equator, where it slightly protruded, and was evidently of greater extent.

We have just received, by the dilatory method of a letter by post, an account of the preparations making and made for the due observation of the Total Solar Eclipse in September, up to within a fortnight of the event coming off; but no more. Our informant, the Venerable the Archdeacon Stock, of Wellington, New Zealand, was momentarily expecting two large auxiliary expeditions,

one from Sydney, the other from Melbourne; and had been himself told off for corona work. But though brimming full of fine enthusiasm to do all that man could do in that department, he yet characteristically adds, "but how can we expect to see any of the more refined and minute features through all this Krakatáo haze which the sun has still to shine through? In 1882, before that great volcanic eruption, we could see the comet of that year close up to the sun's limb; but now I am certain that nothing of the kind could be visible." C. P. S.

15, Royal Terrace, Edinburgh, October 21

NOTES

PROF. PASTEUR read on Monday evening to the Paris Academy of Sciences a statement, of which the following is the substance as telegraphed to the *Standard*:—M. Pasteur some time ago succeeded in rendering proof against rabies some sixteen out of every twenty dogs experimented upon. But to ascertain that immunity had really been given, he had to wait four months after the inoculation had taken effect. He therefore set himself to obtain virus of different degrees of strength, with the object of obtaining prompter and more certain results. This was effected by the following means:—A rabbit was inoculated with a fragment of tissue taken from the spine of a rabid dog. The incubation of the poison occupied fifteen days. As soon as the rabbit was dead a portion of its spinal marrow was in turn inoculated into a second rabbit, and so on until sixty rabbits had been inoculated. At each successive inoculation the virus became of increased potency, and the last period was not more than seven days. Having ascertained that exposure to dried air diminishes the virus, and consequently reduces its force, M. Pasteur supplied himself with a series of bottles containing dried air. In these bottles were placed portions of the inoculated spinal marrow of successive dates, the oldest being the least virulent, and the latest the most so. For an operation M. Pasteur begins by inoculating his subject with the oldest tissue, and finishes by injecting a piece dating from two days only, whose period of incubation would not exceed one week. The subject is then found to be absolutely proof against the disease. At the beginning of July a young Alsatian, named Joseph Meister, who had been severely bitten in several places by an undoubtedly rabid dog, presented himself at the laboratory. His case, left to itself, being considered hopeless by M. Pasteur, Prof. Vulpian, and other high authorities, the patient was submitted to the same series of inoculations that had been so successful on dogs. As a proof a series of rabbits were simultaneously subjected to the identical processes. In ten days thirteen inoculations were made with pieces of spinal marrow containing virus of constantly-increasing strength, the last being from the spine of a rabbit which had died only the day before. The youth thus operated upon by the successive administrations of weaker virus was made proof against the virus of the intensest strength. It is now 100 days since he underwent the last inoculation, and he is in perfect health. Those rabbits, on the contrary, which were at once inoculated with the strong virus, without first being rendered fit to receive it, became affected within the proper incubation period, and died with the usual symptoms. The first inoculation practised upon Meister was sixty hours after he had been bitten. M. Pasteur has, at the present moment, another human patient under treatment who was bitten a few days ago by a mad dog. M. Pasteur said it would now be necessary to provide an establishment where rabbits might always be kept inoculated with the disease. In this way there would constantly be a supply of spinal tissues, of both old and recent inoculation, ready for use. Before the sitting was adjourned M. Pasteur received an enthusiastic ovation from both the Academy and the public present.

THE annual meeting of the five academies forming the French Institute took place at two o'clock on October 24 in the large hall of the Institut; M. Bouguereau, President of the Academy of Beaux Arts was in the chair. The great prize delivered once every two years was awarded to Dr. Brown-Sequard, the well-known physiologist. M. Paul Bert had written a paper "On Vivisection," which was expected as a sequel to the delivery of the prize to Dr. Brown-Sequard, but it was not read for want of time. The annual banquet took place in the evening for the second time.

IT is rumoured that M. Goblet, the Minister of Public Instruction, proposes to return to the former organisation of the Institut, which was regarded as a universal self-electing body. Each class or special academy had not the privilege of choosing its own members as now, but of proposing a list of candidates to the whole Institut. The increased solemnity given to the annual and quarterly meetings, and the institution of banquets, are considered as preparatory to this important change.

M. BERTRAND, who was nominated member of the French Academy some months ago, will be received on December 10 next, at a solemn sitting, when he will read his inaugural address. It will be answered by M. Pasteur.

A VERY valuable addition has recently been made to the Science Collections now displayed in the Western Galleries at the South Kensington Museum of Science and Art. Mr. Rochfort Connor, of the Inland Revenue Department, has prepared a number of exquisitely finished pen-and-ink drawings of objects viewed with the microscope, often by the aid of very high powers. The collection, which covers two large screens in the rooms devoted to biology and geology, include drawings of insects and other minute forms of animals, and of various anatomical preparations from them, of curiosities of pond-life, and of the skeletons of many organisms, both recent and fossil. Among these last Mr. Connor's highly-finished representation of some of the more complicated forms of the Diatomaceæ, such as *Heliopelta* and *Coscinodiscus*, are especially worthy of admiration, though some of his drawings of Foraminifera, Bryozoa, and Sponge-spicules are scarcely inferior to these in delicacy of execution. These drawings represent, we understand, the leisure hours of a busy life-time, and their author is now engaged in a series of microscopic drawings illustrating the characters of food-products and their adulterants. A few of these are now exhibited as samples, and the series when complete cannot fail to be of great use to public analysts and others.

AT a meeting of the Brookville (U.S.) Society of Natural History, September 22 (according to *Science*), a committee was appointed to confer with the scientific associations, educational institutions, and with individuals throughout the State of Indiana, concerning the advisability of the formation of a State Academy of Science, and if thought advisable, to co-operate with such persons in favour of the formation of such an association. Free expression of opinion is called for by the committee, both as to the need of such an organisation and as to the best plan for its composition. It is now the plan to hold a meeting at Indianapolis between Christmas and New Year's day. It proposed that the organisation shall enable the citizens of Indiana who are engaged in scientific work to meet at certain times "for social intercourse, for the exchange of ideas, and the comparison of results of scientific studies." It would appear from the prospectus that the Academy would be a State society similar to the American Association.

SOME theoretical views on the detonation of meteorites have been recently offered by Signor Bombicci in the Royal Accademia dei Lincei. He supposes the detonation to be that of an explosive gas mixture, formed during the surface-heating of the mass in the atmosphere, and accumulating chiefly in the vacuous